WASHINGTON STATE DEPARTMENT OF ECOLOGY

May 2022

GENERAL USE LEVEL DESIGNATION FOR BASIC, ENHANCED, & PHOSHORUS TREATMENT

For

StormwateRx, LLC, Aquip® Enhanced Stormwater Filtration System

Ecology's Decision:

Based on StormwateRx's application submissions, Ecology hereby issues the following use level designation for the Aquip® Enhanced Stormwater Filtration System:

1. A General Use Level Designation (GULD) for Basic, Enhanced, and Phosphorus Treatment:
    - Sized at a hydraulic loading rate of no greater than 1.25 gallons per minute (gpm) per square foot (sq ft) of media surface area.
    - Using the enhanced (sorptive) media
    - Influent by pump station or gravity flow
2. Ecology approves the Aquip® Enhanced Stormwater Filtration System for treatment at the above flow rates. The designer shall calculate the water quality design flow rates using the following procedures:
    - Western Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using the latest version of the Western Washington Hydrology Model or other Ecology-approved continuous runoff model.
    - Eastern Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using one of the three methods described in Chapter 2.7.6 of the Stormwater Management Manual for Eastern Washington (SWMMEW) or local manual.
    - Entire State: For treatment installed downstream of detention, the water quality design flow rate is the full 2-year release rate of the detention facility.
3. The GULD has no expiration date, but may be amended or revoked by Ecology.

Ecology's Conditions of Use:

The Aquip® Enhanced Stormwater Filtration Systems shall comply with these conditions:

1. Applicants shall design, assemble, install, operate, and maintain the Aquip® systems in accordance with StormwateRx's applicable manuals and documents and the Ecology Decision.
2. If you pump influent to the system, pump station and bypass design shall follow local guidelines and codes.
3. The minimum size filter surface-area for use in Washington is determined by using the design water quality flow rate (as determined in Ecology Decision, Item 2 above) and the hydraulic loading rate (as identified in Ecology Decision, Item 1 above). Calculate the required area by dividing the water quality design flow rate (cu-ft/sec) by the hydraulic loading rate (converted to ft/sec) to obtain required surface area (sq ft) of the Aquip unit.
4. Maintenance: The required inspection/maintenance interval for stormwater treatment devices is often dependent on the efficiency of the device and the degree of pollutant loading from a particular drainage basin. Therefore, Ecology does not endorse or recommend a "one size fits all" maintenance cycle for a particular model/size of manufactured filter treatment device.

    - StormwateRx Aquip system maintenance includes routine media maintenance, inert media replacement and sorptive media replacement. Maintenance frequency is site specific and for preventative maintenance purposes is estimated based on elapsed time and/or cumulative flow through the system. Maintenance includes the following:

        - Inert Media Cleaning – remove visible surface accumulation of sediment and discolored inert media from pretreatment and filtration chambers. Top off with new media to original media height when approximately 3-inches of filter media has been removed. Surface media maintenance interval averages 1 month.

        - Inert Media Replacement – replace inert media in filtration chamber when surface media maintenance program results in a continuous operating filtration chamber water level of more than two feet. Replacing the inert media protects the underlying sorptive media and extends sorptive media life. Inert media replacement interval averages 12 months.

        - Pretreatment (OmniPlex) Media – replace the pretreatment (OmniPlex) Media when the inert media is replaced.

        - Sorptive Media Replacement – replace sorptive media in concert with an inert media replacement when the operating filtration chamber water level is greater than two feet despite proper routine and inert media maintenance, or when dissolved pollutant concentrations exceed regulatory standards. Remove accumulated pretreatment chamber sediment and media at time of sorptive media replacement. Pollutant removal capacity of the sorptive media can exhaust due to high loading, inadequate routine, and inert media maintenance, and extended Aquip throughput. Sorptive media replacement interval averages 24 months.

- An Aquip tested at the Lake Union Ship Canal Test Facility in Seattle, WA demonstrated it could go an average of one month or 6% of a water year before needing surface media maintenance. The same unit needed replacement of pretreatment, inert, and sorptive media after 53% of a water year, and pretreatment media replacement alone after an additional 44% of a water year. Monitoring personnel observed similar maintenance issues with other systems evaluated at the Test Facility. The runoff from the Test Facility may not be indicative of maintenance requirements for all sites.
- Owners/operators must inspect Aquip systems for a minimum of twelve months from the start of post-construction operation to determine site-specific maintenance schedules and requirements. Conduct inspections monthly during the wet season, and every other month during the dry season. (According to the SWMMWW, the wet season in western Washington is October 1 to April 30. According to SWMMEW, the wet season in eastern Washington is October 1 to June 30). After the first year of operation, owners/operators must conduct inspections based on the findings during the first year of inspections.
- Conduct inspections by qualified personnel, follow manufacturer's guidelines, and methods capable of determining either a decrease in treated effluent flowrate and/or a decrease in pollutant removal ability.
- When inspections are performed, the following findings typically serve as maintenance triggers:
  - Effluent flow decreasing to below the design flow rate.
  - Accumulated sediment discoloration on the media surface is visually more predominant than filtration media, or
  - Evidence of bypass or operating water levels more than one foot above the inlet distributor, or
  - Standing water remains inside the filtration chamber between rain events, or
  - Treatment system performance has declined for two or more samples, or
  - Jar testing indicates that media samples have accumulated more than 20% solids by volume.

5. Install the Aquip in such a manner that bypass flows exceeding the maximum operating rate will not resuspend captured sediment.
6. Discharges from the Aquip® Enhanced Stormwater Filtration Systems shall not cause or contribute to water quality standards violations in receiving waters.

Applicant: StormwateRx, LLC

Applicant's Address: 8912 NE Alderwood Rd
Portland, OR, 97220

Application Documents:

Technical Evaluation Report, StormwateRx Aquip® Enhanced Stormwater Filtration System Performance Verification Project, Prepared for StormwateRx, LLC, Prepared by Herrera Environmental Consultants, Inc., April 2022

Quality Assurance Project Plan, StormwateRx Aquip® Enhanced Stormwater Filtration System Performance Verification, Prepared for StormwateRx, LLC, Prepared by Marx Environmental Consulting, October 2018

Aquip® Enhanced Stormwater Filtration System, Technology Assessment Protocol – Ecology Application for Certification (January 26, 2011; revised May 20, 2011). Prepared by StormwateRx, LLC. Received May 27, 2011.

Applicant's Use Level Request:

- General Use Level Designation as a Basic, Enhanced, and Phosphorus treatment device in accordance with Ecology's *Stormwater Management Manual for Western Washington*.

Applicant's Performance Claims:

Based on results from field testing, the applicant claims the Aquip®, operating at a hydraulic loading rate of 1.25 gpm/sq ft, is able to remove:

- 80% of Total Suspended Solids (TSS) for influent concentrations greater than 100 mg/L and achieve a 20 mg/L effluent for concentrations less than 100 mg/L
- 60% dissolved zinc for influent concentrations 0.02 to 0.3 mg/L
- 30% dissolved copper for influent concentrations 0.005 to 0.02 mg/L
- 50% total phosphorus for influent concentrations 0.1 to 0.5 mg/L

Ecology's Recommendations:

- StormwateRx, LLC has shown Ecology, through field testing in the Pacific Northwest, that the Aquip® is capable of attaining Ecology's Basic, Total Phosphorus, and Enhanced treatment goals.

Findings of Fact:

Data submitted for GULD (2019-2021)

Herrera Environmental Consultants, Inc. conducted monitoring of an Aquip® at the Lake Union Ship Canal Test Facility in Seattle Washington between April 2019 and May 2021. Herrera collected flow-weight composite samples during 17 separate storm events.

- The system was sized at a hydraulic loading rate of 1.25 gpm/ft^2.
- The average D_{50} of the influent particle size was 51 microns.
- Influent samples from 12 of the 17 events had influent concentrations greater than 20 mg/L. The concentrations of these samples ranged from 20 mg/L to 63 mg/L, with a mean concentration of 38 mg/L. The bootstrap estimate of the upper 95 percent confidence limit (UCL 95) of the mean TSS effluent concentration was 7.7 mg/L.
- Fourteen of the 17 events were analyzed for dissolved copper performance. The influent concentrations from these samples ranged from 7.5 µg/L to 19 µg/L, with a mean concentration of 10.8 µg/L. A bootstrap estimate of the lower 95 percent confidence limit (LCL 95) of the mean dissolved copper reduction was 35%.
- Fourteen of the 17 events were analyzed for dissolved zinc performance. The influent concentration from these samples ranged from 22 µg/L to 80 µg/L, with a mean concentration of 36 µg/L. A bootstrap estimate of the LCL95 of the mean dissolved zinc reduction was 73%.
- Fourteen of the 17 events were analyzed for total phosphorus performance. The influent concentrations from these samples ranged from 0.045 mg/L to 0.760 mg/L, with a mean concentration of 0.153 mg/L. The sample with an influent concentration greater than 0.5 mg/L was capped at 0.5 mg/L for all percent removal calculations. A bootstrap estimate of the LCL95 of the mean total phosphorus reduction was 65%.
- The system experienced rapid sediment loading and could go an average of one month or 6% of a water year before needing surface media maintenance. The same unit needed full media replacement after 53% of a water year, and pretreatment media replacement after an additional 44% of a water year. Monitoring personnel observed similar sediment loading issues with other systems evaluated at the Test Facility. The runoff from the Test Facility may not be indicative of maintenance requirements for all sites.

Data submitted for CULD (2007-2011)

- Based on paired grab sample data for TSS, from 14 installation sites, the Aquip® Enhanced Stormwater Filtration System achieved the following treatment levels:
  - Median effluent was 5 mg/L TSS, influent concentration in the range of 20-100 mg/L (n=32).
  - Median percent removal was 98 percent, influent concentration in the range of 100-200 mg/L (n=8).
  - Median percent removal was 98 percent, influent concentration greater than 200 mg/L (n=8).

- Based on paired grab sample data for dissolved copper, from 7 installation sites, the Aquip® Enhanced Stormwater Filtration System achieved the following treatment levels:
  - Median percent removal was 73 percent, influent concentration in the range of 0.003-0.02 mg/L (n=5).
  - Median percent removal was 93 percent, influent concentration greater than 0.02 mg/L (n=32).

- Based on paired grab sample data for dissolved zinc, from eight installation sites, the Aquip® Enhanced Stormwater Filtration System achieved the following treatment levels:
  - Median percent removal was 59 percent, influent concentration in the range of 0.02-0.3 mg/L (n=30).
  - Median percent removal was 94 percent, influent concentration greater than 0.3 mg/L (n=21).

- Based on paired grab sample data for total phosphorus, from six installation sites, the Aquip® Enhanced Stormwater Filtration System achieved the following treatment levels:
  - Median percent removal was 60 percent, influent concentration in the range of 0.1-0.5 mg/L (n=14).
  - Median percent removal was 89 percent, influent concentration greater than 0.5 mg/L (n=5).

Issues to be Addressed by the Company:

1. Conduct hydraulic testing to obtain information about maintenance requirements on a site with runoff that is more typical of the Pacific Northwest.

Technology Description: Download at: www.stormwaterx.com/Products/Aquip.aspx

Contact Information:

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Revision History

Date	Revision
July 2011	Original use-level-designation document
September 2012	Revised dates for QAPP, TER, and Expiration
January 2013	Updated document format to match Ecology standard, added maintenance criteria
April 2014	Revised Due dates for QAPP and TER and changed Expiration date
June 2017	Revised Due dates for QAPP and TER and changed Expiration date
April 2019	Revised Applicant's address
September 2020	Revised TER and Expiration dates
December 2021	Revised StormwateRx contact name and email address
May 2022	GULD granted for Basic, Enhanced, and Phosphorus Treatment